

Business Case For Academia

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Goal

There is a demand for affordable, and engaging tools for teaching coding and technical skills to young learners.

The project aims to promote STEM education by teaching problem solving and critical thinking skills to children between the ages of 9 to 10. As technology increasingly shapes future job opportunities, there is a growing need for digital literacy from an early age.

Traditional methods fail to retain engagement and retention. If not addressed the next generation will be unprepared for future careers in the STEM field which have spiral effects on university application numbers.

The timeframe for this project is a year which is urgent, especially since not only does the project need to build from scratch but it has to be tested before being implemented

1 Executive Summary

Children must become digitally literate and learn to code at a young age due to the rapid advancement of technology. Traditional teaching approaches frequently fail to engage with kids successfully, resulting in poor memory of key STEM concepts (Thomas and Tian, 2021). To remedy this issue, Academia recommends creating an innovative device that will include games that include teaching coding and other digital skills, increasing retention and participation in STEM education (Gaulddal, 2020). Academia will provide a useful product and thorough service by supplying this technology to schools and teaching instructors on how to utilize it. If effective, the arcade box might help young kids develop important problem solving and critical thinking abilities, which are key for promoting interest in STEM subjects (Adeyeye, Ashaolu and Idowu-Adebayo, 2022). This might result in an inflow of students studying Science, Technology, Engineering and Mathematics (STEM) which would help institutions through enrollment and income.

The goal is to assess potential options for improving digital learning through gaming in order to make coding instruction more interesting and accessible to young learners. Several solutions were assessed on important criteria such as technological capacity, cost-effectiveness, involvement level, and scalability. The Proposed solutions include building a portable arcade box, providing an online learning platform, and constructing a robotics kit. The study found that the Portable Arcade Box is the most practical option, providing immersive and hands-on learning experiences powered by Raspberry Pi. This allows kids to participate in coding in a gamified environment (Ashbourn, 2014). The practicality was evaluated based on engagement accessibility, and technological execution, and the Portable Arcade Box emerged as the best solution for the business challenge.

To efficiently execute this solution, academia will use a disciplined approach that includes Agile techniques and prototyping. The project will be separated into four phases: planning, execution, testing, and implementation. During the planning phase, the team will work with stakeholders to create a thorough project plan that includes all relevant components. The execution phase will be iterative, with weekly sprints providing ongoing feedback and change. Testing will assure product quality, including user participation to confirm the effectiveness of learning experience. Finally, the implementation phase will focus on distributing the arcade box in schools and educating educators to ensure optimal utilization (Gulddal,2020).

2 Business Problem

2.1 MACRO FORCES

Political: Across the world governments agree that STEM education is important when it comes to maintaining competitiveness in the global economy. Academic institutions greatly support integrating technology in curriculums taught at school level in order to prepare students for future industry fields

Economic: Technology continues to significantly contribute to economic growth. There is however a shortage of individuals with the skills to manage and maintain these technologies. By investing in academia and early coding education it is possible to overcome the skill gap.

Social: Digital literacy is increasingly seen as an important fundamental skill, not only by educators but by parents as well. There is a continuous search for innovative ways to teach these skills to equip children with the necessary tools to handle the current digital world.

Technological: The whole project focuses on technology. However, it should be noted that there is a need for more affordable educational technology. By utilizing a Raspberry Pi, the project can be more affordable and adaptable as well.

Legal: It is important to adhere to the educational standards and privacy regulations when creating such projects.

ESG and DEI (Environmental, Social, and Governance & Diversity, Equity, and Inclusion): the project will promote sustainable technology use as well as create advances in DEI by making this product accessible to children in both rural and non-rural areas therefore a diverse population

The main environments in which the problem exists are Economical and Social and this is also where the opportunity lies for improvement and growth. The environment that has the greatest impact on the success of the project is the technological environment. Since the product can become outdated quickly however, we believe that arcades are timeless therefore although it might be a niche product it might be nostalgic and therefore hold its attraction.

The high order opportunities and threats presented in the macro forces are as follows:

- There is a need for STEM educational tools that are affordable, this impacts social, technological and economic factors
- There is a need for digital literacy among students, this impacts the economy since such individuals are more employable.
- There is a need for products that teach coding to be more accessible to every learner regardless of social status, this impacts DEI and Social factors.

Our product will not only address these issues but we will also provide a service to provide a competitive edge.

The major objective is to differentiate services in the education of 21st century skills. The solution enables students to engage with coding and digital literacy in an engaging and entertaining manner, nurturing skills required for success in today's workforce. Unlike traditional educational tools, which frequently emphasize rote learning and standardized examinations, the proposed solution provides students with hands-on, gamified experiences that foster critical thinking, creativity, and teamwork.

Key differentiation benefits include:

- **Customizable Learning Experiences:** Kids may personalize their learning experiences by choosing games and challenges that match their interests and ability levels.
- **Engagement Tracking:** The system includes elements that track student engagement and development, offering insight into areas of strength and chances for improvement rather than relying exclusively on academic success.
- **Proactive Support:** By detecting trends in user interaction and engagement, the solution may provide individualized recommendation and challenges, helping students to establish proactive learning habits and resilience.
- **Fostering Community:** The solution should promote social engagement via collaborative games and challenges, contributing to the development of a supportive learning community that reduces feelings of isolation and strengthens peer connections.

The table below lists the important external stakeholders and consumers who would benefit from the solution as well as the unique requirements and possibilities the systems addresses for each group.

External Stakeholders/ Customers	Needs and Opportunity
Other Schools and Educational Institutions	Many schools fail to engage kids in coding and Stem subjects. The solution should provide an engaging, hands-on learning experience, increasing student retention and enthusiasm in these subject (Wilson 2009)

Government Education Department	Department of education can benefit from increased student digital literacy results by supporting national plans for technology integration and STEM Education (Browne,2010)
EdTech Companies	Companies' educational technology field can use the concept to develop complementary goods or services, promoting collaboration (Booth et al.,2016)
Non-Profit Organizations	Organizations committed to increasing educational access can use the solution to improve STEM education in marginalized populations, fostering in learning opportunities (Gladwell, 2008)
Parents and Guardians	Families are increasingly seeking interesting and instructional resources for children. The solution provides a pleasant approach for young kids to acquire coding skills while addressing parental worries about educational quality (Gaubartz,2015)

Timeline

Short-Term (0-12 months):

- Create a proof of concept for the solution that includes ethical issues and stakeholder participation.
- Conduct pilot deployment in select classes to get early feedback that will help drive future enhancements.
- Begin basic data integration and model training, emphasizing immediate benefit through engaging learning opportunities.

Medium-Term

- The solution has been fully deployed throughout numerous classrooms and schools.
- Improve interactive features and analytics based on student to ensure the user experience is suited to their specific requirements
- Train educators on the best ways to incorporate the solution in their teaching techniques, Resulting in increased engagement and retention.

Long-Term

- Achieve widespread acceptance of the solution in educational institutions, completely integrating it into the teaching process.
- Investigate ways to exchange excellent practices with other educational groups, and even create a national framework for integrating comparable instructional resources.
- Use the system's findings to guide strategic planning, increase students' engagement, and support long-term educational goals.

Window of Opportunity:

With a rising emphasis on digital transformation in education, schools are seeking for new tools to improve learning. By moving promptly, we may gain a competitive edge and provide proactive support for student achievement, ensuring that our product fits the changing requirements of modern education.

Business Opportunities and Treats

Political:	Opportunity	Threat
Government initiatives may give financing or policy support for innovative teaching technologies.	Government efforts encouraging STEM education may include financing or policy support for new instructional tools.	Changes in political leadership or institutional agendas may deprioritize or defund the endeavor.
Educational initiatives that promote early coding literacy can help the effort greatly.	Educational strategies that support early coding literacy can have a big impact on arcade game implementation.	Possible data privacy and regulatory compliance issues may develop during project execution.
Economical	Opportunity	Threat
The solution is built with cost in mind to provide accessibility for all schools.	The solution is built using low-cost components, making it accessible to both affluent and needy schools.	Economic downturns may result in lower budget allocations for non-core educational programs, jeopardizing the project's viability.
There are sponsorship possibilities available from tech firms and universities that support STEM projects.	There are chances for sponsorships from tech firms that support STEM activities, which will help fund the solution.	Despite the low cost, schools in disadvantaged areas may still lack the funds required to implement it.
Competing with established businesses can generate market attention and attraction	Competing with recognized brands and giving new features might boost market interest.	Competing items from existing companies may reduce demand for this new offering in the marketplace.
Social	Opportunity	Threat
The significance of early coding skills are more widely recognized.	There is a rising understanding of the need of teaching coding at a young age, highlighting the need for instructional tools.	Some parents and educators may be hesitant to incorporate coding instruction into curriculum due to concerns about job displacement.
Gamification of learning is an excellent way to increase student participation.	Gamification of learning has been shown to increase student engagement; therefore, the solution appeals to both students and educators.	Resistance may occur due to a preference for traditional teaching methods among educators and parents, limiting the game's acceptance.
Parents and educators are increasingly investing in digital literacy programs.	Parents and educators are increasingly investing in digital literacy, resulting in a robust market for instructional coding tools.	Some stakeholders may reject the use of new technology in favour of traditional educational approaches, impeding development.

Technological	Opportunity	Threat
Recent advances in educational technology have facilitated the creation of interactive tools.	Recent advances in educational technology have facilitated the creation of interactive learning resources.	If the solution does not keep up with technological improvements, it will become obsolete very rapidly.
Cost-effective hardware components improve the viability of development.	The availability of low-cost hardware components increases the viability of production for educational purposes.	Hardware updates may be difficult to implement since disassembly may be necessary for maintenance and upgrades.
Cost-effective software solutions make it easier to design and maintain applications.	Cost-effective software solutions make it easier to design and maintain solution, assuring their long-term profitability.	Dependence on third-party software may present vulnerabilities or compatibility concerns, thereby jeopardizing functioning.
Ecological	Opportunity	Threat
Digital learning significantly decreases paper waste and efficiently helps environmental goals.	Digital education promotes eco-friendly behaviours, which lowers paper waste and helps educational sustainability projects.	Concerns regarding e-waste from old or abandoned gear may develop, posing environmental risks.
Sustainable materials in hardware can help to enhance the product's eco-friendly reputation.	The use of sustainable materials in hardware can help the product project an eco-friendly image, making it more desirable to environmentally concerned buyers.	Environmental restrictions for e-waste disposal may place new responsibility for producers.
Legal	Opportunity	Threat
Compliance with educational technology regulations promotes credibility and confidence.	Compliance with educational technology rules promotes credibility and confidence among stakeholders in the educational community.	There is a requirement to follow different educational and child safety laws, which may complicate the implementation process.
Successful compliance can lead to credible uptake in the learning environment.	Successful compliance with established educational institutions can help to promote the solution as a respectable learning tool.	Data privacy, child protection, and ethical clearance issues must all be handled in order to prevent potential legal liability.

2.2 MICRO-LEVEL ENVIRONMENTAL ANALYSIS

Analysis of Potential Vendors and Substitutes

Aspect	Description	Impact on Arcade Game Development
Competitive Rivalry	Few rivals specialize in educational games; most offerings are traditional gaming or educational tools.	Low rivalry enables for market distinctiveness creating an opportunity to conquer the educational gaming sector
Treats of New Entrants	To enter the gaming business, you must have game experience and adhere to educational norms.	The game faces a moderate threat from existing companies, but its unique educational focus provides a protected sector.
Supplier Power	Game manufacturing components (Such as hardware and software) are readily available and reasonably priced.	Low supplier power allows for greater flexibility in material procurement while also keeping manufacturing cost acceptable.
Technological Trends	Advances in mobile technology and game creation tools make it easier to create compelling arcade games.	Positive influence, since technology allows for more dynamic and enticing gaming elements, drawing a larger audience.
Market Demands	The growing interest in gamified learning and coding education highlights the need for creative educational tools such as arcade games.	High demand coincides with educational trends, accelerating the creation and acceptance of arcade games in schools and beyond.
Regulatory Environment	Compliance with educational rules and child security standards is critical to product acceptability in schools.	Meeting regulatory criteria boosts credibility and confidence among educators and parents, making market entrance easier.

Problem Analysis

1. Are there potential vendors that developed or can develop, sell, and maintain such an IT product or service? (Competition)

There are several potential vendors capable of creating, distributing and supporting a game focused at improving coding education. Established EdTech firms like Code.org and Tynker are key participants in this field. These organizations have already created strong coding platforms geared towards engaging young learners. Given their skills and resources, they are well positioned to broaden their offers to include game-based learning tools. This might entail incorporating interactive gaming components into their current platform increasing user engagement and educational outcomes.

Furthermore, schools and educational organizations devoted to advancing STEM education have the means and incentive to develop and maintain such a product. These schools frequently have funds, competence in curriculum creation, and a thorough awareness of their students' requirements. They might possibly design games that correspond with educational requirements and foster collaborations with technology companies.

A collaborative approach among these providers may promote innovation by sharing insight, resources, and experience in order to develop engaging instructional solutions. As the need for gamified learning experiences grows, these prospective providers play an important role in influencing the future of educational technology by encouraging young learners to participate in coding STEM fields. Their current infrastructure and market presence create a solid basis for the effective creation and management of such IT solutions.

2. Are there Substitute products or services that can satisfy the need?

There are several online coding platforms and educational products that provide coding teaching, but not all of them are especially tailored for younger learners or structured. Websites such as CodeCombat and LightBot offer entertaining coding education through interactive games that might be appealing to beginners. However, their complexity may not necessarily correspond to the development needs of younger children, making them less appropriate for that group.

The kano project takes a different approach, selling kits that allow children to construct their own computers and develop games. This hands-on approach promotes creativity and enables younger kids to interact with technology in a practical way. The product Lego Mindstorms might be regarded as an alternative to educational gaming because they promote problem -solving and coding through robotics. However, they lack the digital interaction and cost limit accessibility for some schools and students.

Applications like hopscotch and Daisy the Dinosaur offer coding fundamentals in an easy-to-understand fashion, making them accessible to younger audiences. While these programs teach vital coding skills, they may not often have a gaming structure. This identifies the market need for a solution that blends gaming pleasure with efficient coding teaching designed exclusively for younger learners. By meeting these demands, a new product might effectively pique the attention of both students and instructors, filling a need that present options do not adequately cover.

3. Are there potential New entrants to the market that can develop, sell, and maintain products and services to satisfy the need?

Tech companies going into education are especially well positioned to penetrate this industry. By leveraging their current skills in software development, user interface, and data analytics, these organizations can create educational products that not only teach coding but also foster critical thinking and creativity in young students. Many software businesses are already looking into methods to incorporate gamification into learning processes, making education more entertaining and effective. Their agility and readiness to experiment with new ideas can result in the creation of innovative, engaging products that appeal to both students and instructors.

Furthermore, STEM education groups are increasingly realizing the value of offering students with easy-to-use programming tools. These organizations are driven by a desire to promote fairness in education and guarantee that all children, regardless of background, have the chance to learn coding. By entering the market with low-cost alternatives, these groups may fill gaps created by existing products, therefore serving underprivileged communities and schools. Their emphasis on price and accessibility has the potential to foster widespread acceptance of coding education, particularly in places with low resources.

The proliferation of online learning platforms and mobile applications has reduced the barriers to entry for new firms. Entrepreneurs may create educational products with relatively cheap initial costs by leveraging cloud-based technology and existing frameworks. This democratization of technology enables a wide range of solutions to develop, each customized to certain educational requirements and populations. Overall, the mix of big tech businesses expanding into education and STEM-focused groups seeking to provide low-cost tools creates a dynamic environment for new entrants. These newcomers have the ability to innovate and broaden the range of instructional goods accessible, therefore satisfying the rising need for effective coding education among young students

4. Are there Suppliers available from whom we can source the required resources to develop, sell, and maintain the necessary IT products or services?

- **Takealot:** Takealot is a popular online shopping site that sells a wide range of items, including Raspberry Pi boards, sensors, and other electronic components. They offer software solutions and instructional resources to help coding education. Their vast selection and dependable shipping make them an easy choice for purchasing vital supplies.
- **Pishop:** Pishop is a company specializing in Raspberry Pi devices and accessories. They provide a large assortment of Raspberry Pi boards, kit, and related components, making them a good choice for assembling the Portable Arcade Box. Pishop also offers educational resources and assistance for teachers and students, which are in line with the project's aim. packages.

Benefits and Cost Analysis of Alternatives

Vendor	Strong Points	Weak Points
Opportunities and Challenges in Coding Education:	The existing market has a limited concentration on specialized coding instruction, which provides opportunity for new entrants.	Established suppliers charge high license prices, limiting accessibility for newbies.
Gap in Practical Education:	Most current suppliers promote artifacts above actual coding education, leaving a large gap in the market.	There is less hands-on involvement with tangible components, lowering learner engagement.
Limited Competition:	The lack of attention on educational implementation leads to fewer competitors in the coding education area.	A restricted concentration on established procedures stifles the creation of novel solutions.

New Entrant	Strong Points	Weak Points
Innovation and Trust Issues:	New entrants can bring innovative solutions to the industry, generating interest.	New entrants may suffer a lack of trust compared to established providers, which might hinder early acceptance.
Partnership and Visibility Challenges:	Opportunities for partnerships in STEM education can boost the credibility and reach of innovative products.	New entrants sometimes struggle to establish exposure in a crowded market.
Cost Accessibility and Resource Limitations:	Lower-cost models with possible sponsorship can help make educational opportunities more accessible.	Limited resources may have an impact on the success of emerging enterprises' marketing and growth efforts.
Substitute Product or Service	Strong Points	Weak Points
Established Tools and Affordability Issues:	Established goods, such as Kano modules and EV3 robotics kits, offer acknowledged and successful STEM learning opportunities.	The high cost of these technologies makes them less accessible to schools with limited resources.
Familiarity and Competitive Pressure:	These technologies are frequently utilized in educational contexts, assuring familiarity for both instructors and students.	More cheaper versions can offer comparable educational value, boosting market competitiveness.
Suppliers	Strong Points	Weak Points
Component Availability and Prototyping Cost:	The availability of a diverse variety of electrical components facilitates product development for instructional equipment.	High upfront expenditures for prototype and manufacturing might be a barrier for new enterprises entering the market.
Own Solution	Strong Points	Weak Points
Tailored Educational Tools and Maintenance Needs:	The suggested teaching tool is specifically developed for young learners, which increases their involvement.	To be relevant and effective, the product must be updated and maintained on a constant basis.
Cost-Effective Solution and Expertise Development:	This solution is less expensive than other kits while yet offering excellent hands-on learning opportunities.	Developing in-house knowledge might take time and resources, potentially delaying the product's introduction.

3. Implementation Approach

To complete the project, a combination of prototyping and agile approaches will be used. This will enable for iterative development, ongoing input, and responsiveness to customer demands throughout the project's lifespan.

3.1 Project Initiation

The project will start with the filling of tender documents for the research proposal. The project leaders will then have a meeting with the client, stakeholders, and end users to determine particular needs. This initial meeting will ensure that all stakeholders agree on project expectations. The project will be defined on the insight gained from this discussion and the tender paperwork. This outlined project will be presented to the stakeholders to ensure that all criteria are met.

3.1.1 Project Team

Project Leads: Melanie and Inge

Client: Prof Neels Kruger

Project Manager: Given Mnisi

3.2 Project Planning

The Project will be divided into four distinct Phases: Planning, Building, Testing and Implementation.

3.2.1 Planning

In this project Melanie and Inge be will be working with Prof Neel to coordinate activities during the planning phase. The team will work with stakeholders, clients, and end users to develop a detailed project strategy. This will entail getting thorough feedback from all partners to ensure that all relevant project components are handled. A job list will be developed and presented on a Kanban board to help with work division and team transparency. Furthermore, a timetable will be created to guarantee that all deliverables are finished by the deadlines, leaving enough time for testing and feedback.

3.2.2 Building

Melanie and Inge will focus on completing the task allocated to them during the planning phase. The team will collaborate to create the solution in accordance with the specified parameters. Weekly meetings will be held to review progress, address barriers, and keep the project on schedule. This regular contact will assist identify and handle any concerns as soon as possible, keeping the project on track.

3.2.3 Testing

Testing will be important to ensure the program's quality and operation. Prior to final deployment, the team will perform thorough testing of the product to reduce faults. To involve stakeholders and end users, a small-scale presentation will be arranged to highlight essential deliverables. This presentation will guarantee that stakeholders are happy with the outcome and reduce opposition to change.

3.2.4 Implementation

Finally, during the implementation phase, the solution will be deployed. The technology will be implemented on-site, making it fully operational and available to the user. End-users will receive training sessions to help them use and understand the product. This training will help users feel comfortable and confident in using the new product efficiently.

3.3 Project Execution

The execution phase will include four major areas to guarantee effective communication and progress monitoring, with a focus on prototyping and Agile methods.

3.3.1 Sprint

The project will remain organized into weekly sprints, but there will be a greater emphasis on generating prototyping inside each cycle. Melanie and Inge will convene a planning meeting at the start of each sprint to establish deliverables and assign responsibilities, ensuring that prototypes are consistent with user input and project objectives.

3.3.2 Daily Stand-Ups

Meetings will continue to take place, allowing team members to check in on their progress and discuss any challenges. However, these discussions will also focus on the status of prototypes and any quick input from stakeholders or end-users, encouraging a more adaptable approach to development.

3.3.3 Feedback Integration

Following each sprint, the team will host a review of finished work and prototypes for stakeholders. This will entail getting input on both the final deliverables and the prototypes. The insights acquired will guide the next iteration, ensuring that the project stays sensitive to user demands and allows for modifications based on real-time input.

3.3.4 Project Closure

Steps for transferring deliverables will include:

- Location Inspection: Evaluating available hardware to determine improvement required for effective delivery.
- Installation: Deliverables will be installed on the primary computer to guarantee universal access across all devices.
- Training: The project team will teach end-users (teachers and kids) to ensure a smooth transition to the new system.
- Customer Sign-Off: Following successful implementation, Prof. Neels will formally sign off the project.
- Reflection Meeting: A meeting will be arranged to go over project results and discuss lessons learned.
- Project Closure: After the reflection meeting, the project will be formally closed.

3.3.5 Project Management

Cost Management: The Cost Manager will handle the financial part of the project to ensure that it stays under budget and that any financial setback is successfully managed.

Quality Management: The team will conduct frequent evaluations to verify that all deliverables satisfy the set quality standards.

Change Management: Regular meetings will assist to mitigate pushback against changes. The team will teach end-users (Teachers and kids) to help them mitigate the new system successfully.

Risk Management: Risk Management will be done by addressing possible risks and to minimize the influence it can have on the project.

Issue Management: In collaboration, the following process will be followed for managing issues:

- 1.Document problems using project management software or Excel.
- 2.Outline the specifics of each issue.
- 3.Determine the reason and accountable parties
- 4.Set a deadline for settlement to avoid escalation.
- 5.Create and implement a resolution.
- 6.Keep track of concerns for further references.
- 7.Provide updates to important stakeholders.

Procurement Management: The team will oversee procurement to ensure that all essential resources are obtained for project completion.

Communication Management: A communication plan was developed addressing:

- What needs to be communicated.
- Who is the audience?
- Responsibility for managing specific communications.
- Authority for releasing communications.

Acceptance Management: Each delivery will be reviewed against acceptance criteria once completed to ensure alignment with stakeholder expectations.

4. Synthesis of Opportunities and Treats

Core Business Problems

The main business issue is a lack of compelling and effective materials for teaching coding skills to younger kids. This problem stems from a number of issues, including a lack of access to innovative coding programs and a growing need for teaching tools that can successfully attract children's attention.

Reasons for Existence

1. Educational Gaps: Many schools lack the infrastructure and resources to deliver comprehensive coding tools to teach these digital skills to young kids (Giddens and Sutton, 2021).
2. Digital Literacy Gap: Many young kids lack basic computer abilities, which are becoming increasingly vital in today's technologically advanced environment. This gap emphasizes the need for engaging coding materials that promote early digital literacy (Booth et al., 2016).
3. Social and Emotional learning: Coding promotes problem solving, perseverance, and creativity. Coding may assist in improving social, and emotional skills, which are becoming increasingly recognized as important in education (Wilson, 2009).

Impact on the Business

1. Low Participation Rates: Children's decreased interest in coding may result in lack of future talent in technological fields.
2. User input and Iteration: An engaging product encourages user feedback, which may be extremely beneficial for ongoing development and innovation, helping the organization to stay ahead of industry trends.
3. Positive Social Impact: Helping younger kids learn coding and digital skills may boost the company's social responsibilities reputation and attract socially aware consumers and investors.

Timeframe for Resolution.

Immediate action is required, preferably within the next 6-12 months, to capitalize on the growing demand for innovative educational tools. This timeline is consistent with the industry trends that indicate rising interest in coding instruction, particularly in light of technology improvements and drive for digital literacy.

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